EA-SDA14 Acoustic Recorder

Key characteristics

- Autonomous and wired mode
- Up to 4 hydrophones simultaneously
- 24 bits acquisition
- Selectable bandwidth acquisition
- Native 128GB SD Card
- Programmable recording schedule
- Battery and attitude monitoring
- 700m depth

Options

- 1TB/2TB HDD or 600GB SSD memory extension
- Additional battery for larger autonomy
- Temperature/Pressure additional sensors

Fields of application

- Offshore and environment
- Scientific instrumentation
- Autonomous passive recording
- Hydrophones network

Example of use

Simultaneous recording of 3 sensors :

1 passive hydrophone:
Broadband and high level monitoring with RESON TC4014

And 2 active hydrophones:
Seismic and acoustic monitoring with HTI-96-MIN
Bio-acoustic wide band noise impact study with B&K8106

Samples are recorded on SD Card or HDD and directly accessible via Ethernet interface.

Description

EA-SDA14 is a compact autonomous recorder able to acquire up to 4 wideband hydrophones simultaneously.

The Acoustic Recorder accepts both passive and pre-amplified active hydrophones. Its wide band analog input allows up to 1MHz with a dynamic range greater than 100dB guaranteeing efficient signal to noise ratio.

The embedded digital signal processor allows high speed acquisition, filtering and storage.

In autonomous mode, data is stored whether on SD Card or hard drive.
In towed mode, data is stored then transferred via Ethernet.

Its power consumption is between 0.6 to 2.5W in active mode and less than 1mW in sleep mode.

EA-SDA14 can be programmed with a mission schedule including date of beginning, sleep and record periods in order to improve battery life.

The configuration and monitoring are facilitated through web browser interface.

Dimensions: length 320mm / diameter 120mm
Weight (air / water): 5kg / 2kg for the smaller EA-SDA14

Table of contents

Technical characteristics 3
- Hydrophone inputs 3
- Digitalizing 3
- Programmable parameters 3
- Configuration examples 4
- Embedded sensors 4
- Monitoring 4
- Power supply 4
- Data Memory 5
- Operating limits 5

Operation 6
- Recorder modes 6
- Data Format 6
- Data storage 6

Autonomy 7

Available options 8

Mechanical characteristics 10
- Product overview 10
- Dimensions 10
- Tapes 11
- Packaging 12

Software 13

Contact 17

Notes 17

Technical characteristics

Hydrophone inputs

Analog inputs are pre-amplified with fixed gain and are designed for both single ended or differential modes. They accept wide dynamic signal range from the hydrophone sensor.

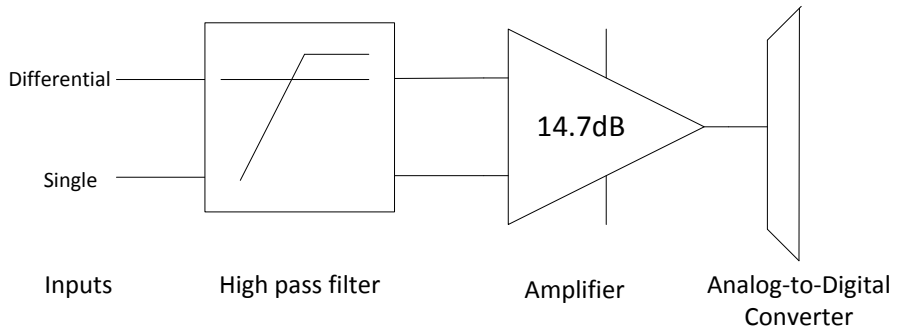


Figure 1: Input functional diagram with default 14.7dB amplification.

Typical characteristics:

The following values correspond to a typical input amplifier gain of 14.7dB

- Input impedance: 500 ohms (*)
- Max Input Level (MIL) -10dBV / 920mVpp **
- Sensitivity (200Hz band): -123dBV / 0.7µV RMS
- High pass filter: 350Hz at -3dB (*)
- Surge peak to peak voltage: 300 Volts (Time < 10ms)

* Other values available on request

** Spurious free dynamic range greater than 80dB is guaranteed with hydrophone signals up to $\frac{\text{Max Input Level}}{2}$

Digitalizing

Analog to digital sampling frequency is configurable.
The table below shows the ENOB (Effective Number Of Bits) and SNR (Signal to Noise Ratio).

Acquisition speed	*39.0625kS/s*	*78.125kS/s*	*156.25kS/s*	*312.5kS/s*	*625kS/s*
ENOB	20 bits	19.5 bits	19 bits	18.5 bits	18 bits
SNR	108dB	105dB	102dB	99dB	96dB

Programmable parameters

The digitalization parameters of hydrophones are:

- Reception channels selection : A, B, C, D (A and/or B and/or C and/or D)
- Sampling frequency(*): 2.5MS/s, 1.25MS/s
  625kS/s, 312.5kS/s, 156.25kS/s, 78.125kS/s, 39.0625kS/s

* All these frequencies are including an anti-aliasing filter of 90 dB minimum

Configuration examples

Most common use	Gain (dB)	Max connector level (V)	Sh (dBµPa/V)	Max pressure level (dBµPa peek-peek)
Mammal Studies	14.7	+/- 0.92V	-170	169.3
	0	+/- 2.5V	-170	184
Noise monitoring	14.7	+/- 0.92V	-155	154.3
	0	+/- 2.5V	-155	169
Piling	0	+/- 2.5V	-200	214
	-30	+/- 79V	-200	244

Embedded sensors

Sensor	Accuracy	Function
RTC (saved by battery)	+/-2 ppm	System clock Sleep and wake-up
3 axis accelerometer	1mG	3 axis acceleration measurement (XYZ) Inclinometer with pitch and roll
3 axis gyroscope	8.75 mdps	3 axis gyration measurement
Optional Sensor	**Accuracy**	**Function**
Temperature (analog)	+/-0.15 °C	Temperature measure (in water)
Pressure (analog)	+/-0.1% Full Scale	Pressure measure ~ Operating depth
GPS	+/- 1.5 m	System position

Monitoring

Measure	Accuracy	Function
Power voltage (Vin)	+/-10 mV	Power supply voltage monitoring
Power current (Iin)	+/-5 mA	Power supply current monitoring
Board temperature	+/- 1 °C	Board temperature monitoring

Power supply

Power supply	Capacity*	Description
6x D Size Li-SOCl2 Battery	216W.H	Internal energy storage
Or 6x D Size Alkaline Battery	91W.H	Internal energy storage
Ethernet Cable + Power supply	-	Communication and power cable
Optional power supply	**Capacity***	**Description**
18x D Size Li-SOCl2 Battery Extension	650W.H	Extended room for 18 D Size Li-SOCl2 Batteries
54x D Size Li-SOCl2 Battery Extension	1950W.H	Extended room for 54 D Size Li-SOCl2 Batteries
Li-Ion Battery	156W.H	Rechargeable Battery [Future use]
Li-Ion Battery Extension	468W.H	Rechargeable Battery [Future use]

**indicative value depending on batteries specifications*

Data Memory

Minimum storage	*Capacity*	*Description*
SD Card (SD HC)	128GB	.wav acoustic files recording
SD Card (SD HC)	256GB	.wav acoustic files recording
Additional storage	***Capacity***	***Description***
Mass storage (SSD)	600GB	.wav acoustic files recording
Hard drive 2.5’	1TB	.wav acoustic files recording
Hard drive 2.5’	2TB	.wav acoustic files recording

Operating limits

- Use/Storage max temperature: 0 to 70°C / -20 to 85°C
- Hydrophone preamplifier max current: 20 mA

Operation

EA-SDA14 Acoustic Recorder is provided with an interfacing box.

It communicates through an Ethernet link. A web interface can be used for mission programming, data collection, monitoring and live analysis.

The LED button indicates the recording status.

Figure 2 : View of the EA-SDA14 recorder

Recorder modes

Three modes are available:

- Manual: Preferred for quick in situ measurement. The recorder waits an action on the button to start recording a pre-programmed length.

- Autonomous: The mission starts automatically at a programmed wake-up time, and do several wake-up/record/sleep cycles until it reaches its mission end date. The hydrophone signals are acquired and registered during active phases.

- Towed/Connected: The recorder is connected to a computer through its underwater Ethernet cable (10-100m). It is started once the button is pushed and a live analysis of the acoustic signal can be done via the web interface. The acoustic data can be displayed, recorded and downloaded in real-time.

Data Format

The acquired data are stored in .wav 16, 24 or 32 bits files.

The name of .wav files are based on channel ID, date and time.
All channels A, B, C and D are running at the same sampling frequency. Sampling rate is programmed via the graphical-interface and data are recorded in a multi-channels .wav file.

Data storage

There are 2 storage locations on the acoustic recorder:
- A 128GB or 256GBSDCard
- An optional high capacity HDD (Hard Drive Disk) or SSD (solid-state drive).

The user can select between 3 strategies to store its data:
- SDCard only mode to limit battery consumption.
  This mode is limited to 3 channels@625KS/s or 4 channels@312KS/s.
- Hybrid mode.
  This mode is the preferred mode for high capacity storage and low power consumption. Data is stored on SDCard and, at the end of recording cycles; data are transferred onto the high capacity HDD or SSD storage.
- HDD only mode.
  This is used for highest acquisition speed. (More than 4MB/s data rate).

Autonomy

The autonomy of the acoustic recorder depends on:

- Battery capacity
- Storage capacity
- Acquisition quality
  - High quality (Higher sampling rate and calibrated channels)
  - Low power
- Recording strategy
  - SD Card only
  - Hybrid mode
  - HDD only

Battery life:

SDcard only recording, continuous mode:

Configuration	*1 channel*	*2 channels*	*3 channels*	*4 channels*
6 Li-SOCl2 batteries	132H	118H	107H	98H

Hybrid mode recording, 50% duty cycle:

Configuration	*1 channel*	*2 channels*	*3 channels*	*4 channels*
18 Li-SOCl2 batteries	720H (30Days)	652H (27Days)	595H (25Days)	548H (23Days)
54Li-SOCl2 batteries	90 Days	82 Days	74 Days	69 Days

Storage capacity

Indicative board below shows the required storage capacity for 1 hydrophone channel acquisition and different sampling rate. In order to respect the signal dynamic the samples are saved as 16, 24 or 32 bits .wav files. In this example, the samples are saved as 24bits files.

Acquisition speed	*39.0625kS/s*	*78.125kS/s*	*156.25kS/s*	*312.5kS/s*	*625kS/s*	*1.25MS/s*	*2.5MS/s*
Per hour	421MB	844MB	1.68GB	3.4GB	6.8GB	13.5GB	27GB
Per day	9.7GB	19.3GB	38.6GB	77.3GB	155GB	324GB	618GB

* Required memory size depends of the number of active channels.

Data throughout = Nb channels * Sampling freq * Nb Bytes / (1000. * 1000.) MiB/s

Recommendations

- In order to maximize the battery life of the acoustic recorder, select only the useful channels
- It is needed to schedule the mission: Date of start/end then sleep / record time slots

Available options

Pressure (depth) and temperature sensor

There are 2 sensor rated for 300 or 700 meter deep. It is a high precision calibrated sensor at 0.1% or 0.2% of the full-scale depending of the depth.

Deep	Accuracy
200m	0.1% / 0.2m
700m	0.2% / 0.7m

Hydrophone Adaptation Board

This option allows adapting the voltage, the impedance and the attenuation for specific hydrophones.

When ordering this option specify for each channel:
- Voltage for each channels with V < 24V.
- Requested impedance, up 500K ohm.
- Attenuation factor (0dB, -10dB, -20dB, -30dB)

Example of use:

- Passive hydrophones that need to be charged with very high impedances.
- High quality B&K or Reson hydrophones that needs higher voltage power.
- Pilling application that needs passive hydrophones and attenuated channels.

GPS input

This option once activated will grab a GPS input from an external serial port and will time log NMEA data in correlation with acoustic data for later processing.
A separate time stamped data file is recorded to correlate the recorded sounds with the recorder position.

When ordering specify whether to use a dedicated 4 way subconn input or instead of a recorder channel.

HDD option

This option allows the recorder to grab a larger quantity of data and to record at higher frequency.
A recorder with HDD option automatically gets Hybrid and HDD only mode.
The maximum recording speed goes from 625KS * 3 channels to 2.5MS/s * 2 channels

3 models are available:
- 1TB HDD
- 2TB HDD
- 600GB SSD

Mounting brackets

The brackets are used to protect the recorder. They can be used to mount the recorder onto a mooring line or to tow it from a boat.
It is specifically designed to work with traction efforts.

Communication cable

The recorder is sold with a standard 10m communication cable.
This length can be adapted to your needs up to 100m.
For application needing long range deployment up to 1.5Km, see long range communication extension.

1.5 km distance cable communication

Some application needs to remotely monitor acoustic environment in a deported way.
We provide extension system that allows to remotely control the recorder up to 1.5KM.
The user can launch recording, monitor the behavior of the system and grab the data from the remote system while it is recording.

Attitude sensor (3 axis gyro/accelero)

This option records the attitude of the recorder through a 3 axis gyroscope and 3 axis accelerometer.
It is useful in case of long deployment. If you want to monitor how the recorder has been deployed and anything happen while recording.

Mechanical characteristics

Product overview

Figure 3 : View of different sizes EA-SDA14 Acoustic Recorder. Operates down to 700m deep.

Central tube is made of hard-anodized aluminum. The end caps are manufactured in POMC. Protections are made of 316L stainless-steel. They protect the connectors and allow setting of shackles.

Dimensions

The EA-SDA14 recorder is available in 3 different sizes: 1210mm, 550mm and 320mm.
This allows having longer mission autonomy.

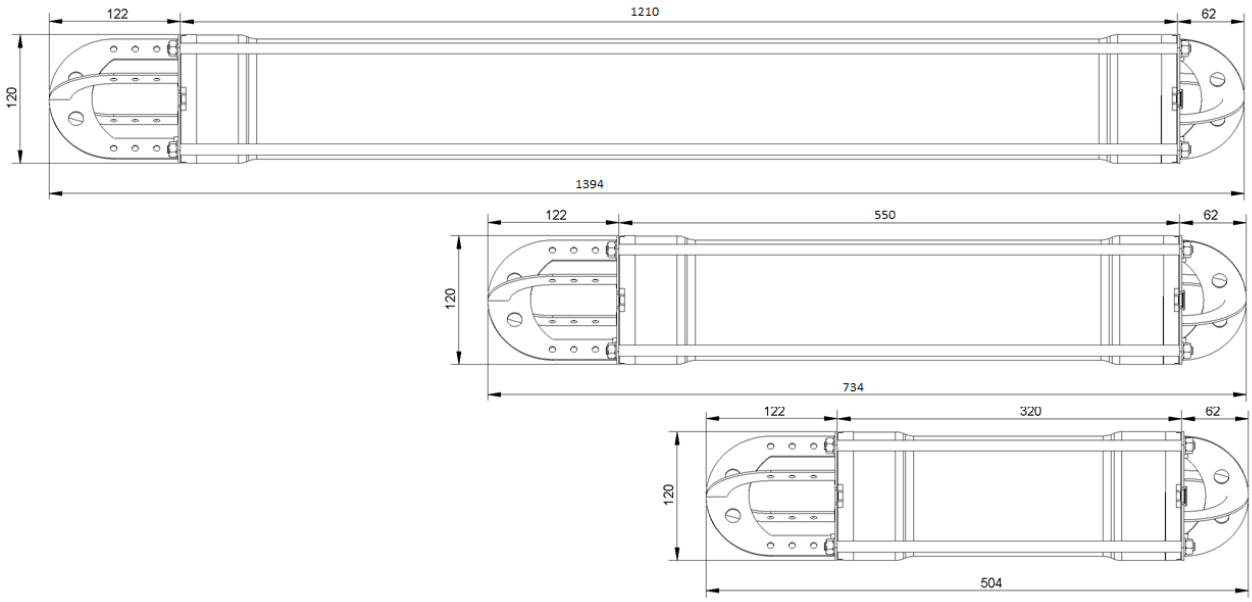


Figure 4 : Dimensions in mm of the different sizes EA-SDA14 Acoustic Recorder.

➔ ***Details about dimensions and weight***

Waterproof housing dimensions are 320mm in length and 120mm in diameter for the smaller recorder, 550mm and 120mm for the intermediate and 1210mm and 120mm for the bigger. It weights ~5kg in air and ~2kg in water for the 320mm recorder, ~9kg and ~4kg for the 550mm and ~20kg and ~10kg for the 1210mm.
The surrounding protections can be removed or used as a mounting bracket.

Tapes

Four different tapes are available, depending of the option you've chosen on your recorder.
Here there are the 4 taps: A, B, C and D.

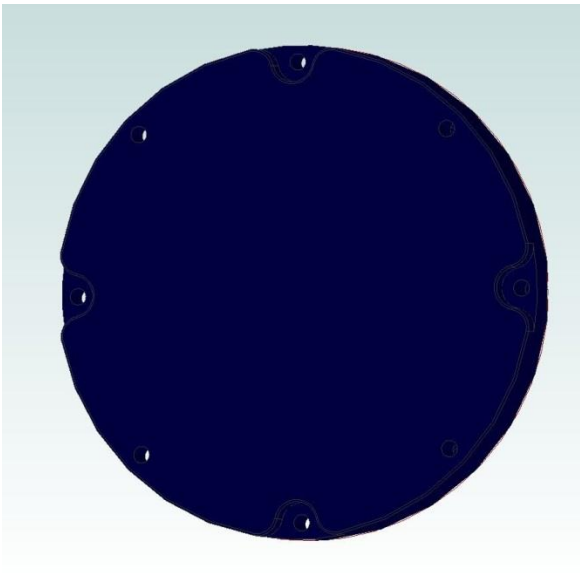


Figure 5.3 : A Tap

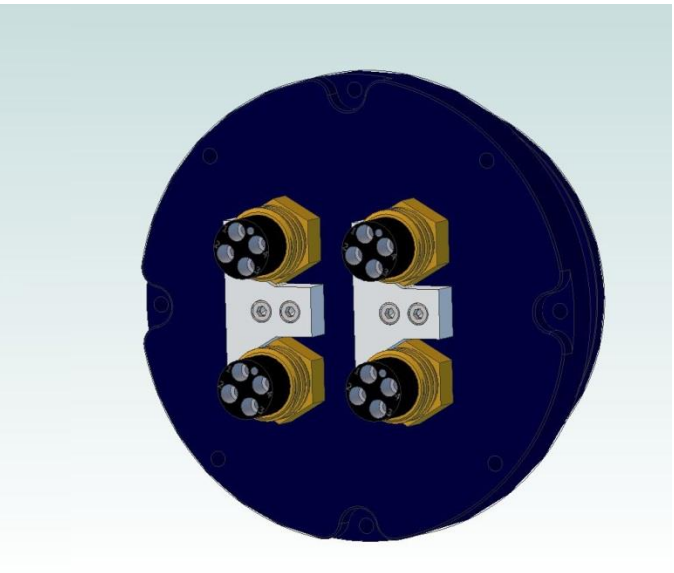


Figure 5.4 : B Tap

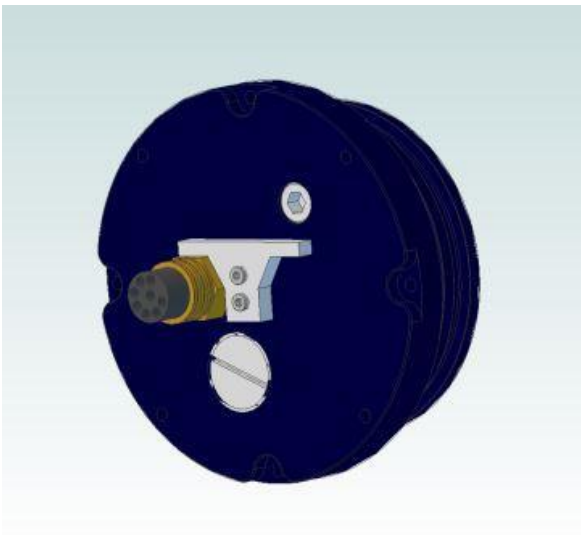


Figure 5.1 : C Tap

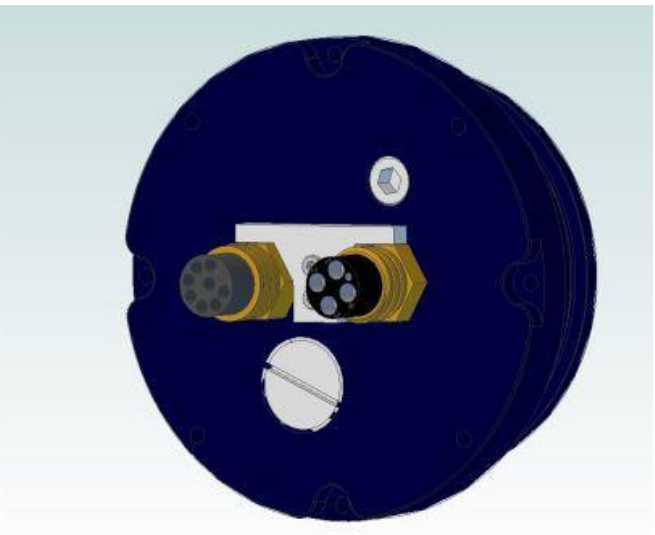


Figure 5.2 : D Tap

Packaging

EA-SDA14 is delivered into a waterproof case.

Material included :
EA-SDA14 in its protected waterproof enclosure
Hydrophone(s)
Ethernet long cable (10m)
6x LSH20, 18x or 54x LS33600 battery
User manual
Software & SDCard

Software

The software is configurable with a web browser via Ethernet.
The web interface provides user-friendly access to the features of the card.

User interface

- System configuration
  - Fixed IP address or DHCP
  - System clock, date programming of the system

- System internal status
  - Input voltage and current monitoring
  - System temperature

- Mission configuration
  - Sleep/record period programming
  - Acquisition channels selection
  - Sampling frequency

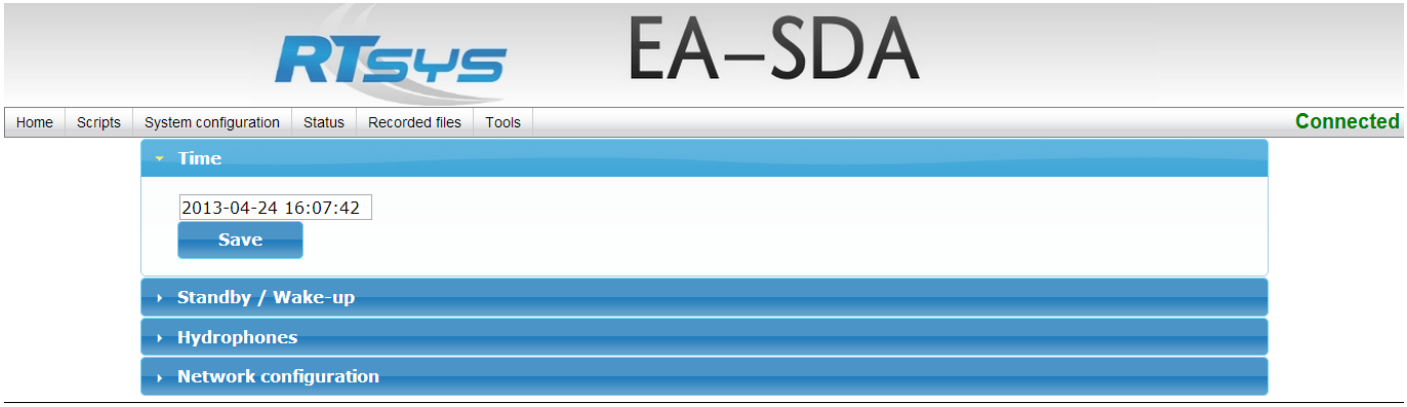
- Access to the recorded acoustic data files (.wav) with separation between SD card - HDD
  - Possibility of downloading the recorded data
  - Possibility of erasing the data stored

- Live script
  - Display the acquisition channels graph
  - Display live FFT of each channels
  - Launch a record directly from web interface for quick analysis

- Tools
  - Wave splitter, Wave header information
  - Web browser and plugins
  - Calibration data in pdf and excel format
  - Datasheet in pdf format

Overview of the configuration

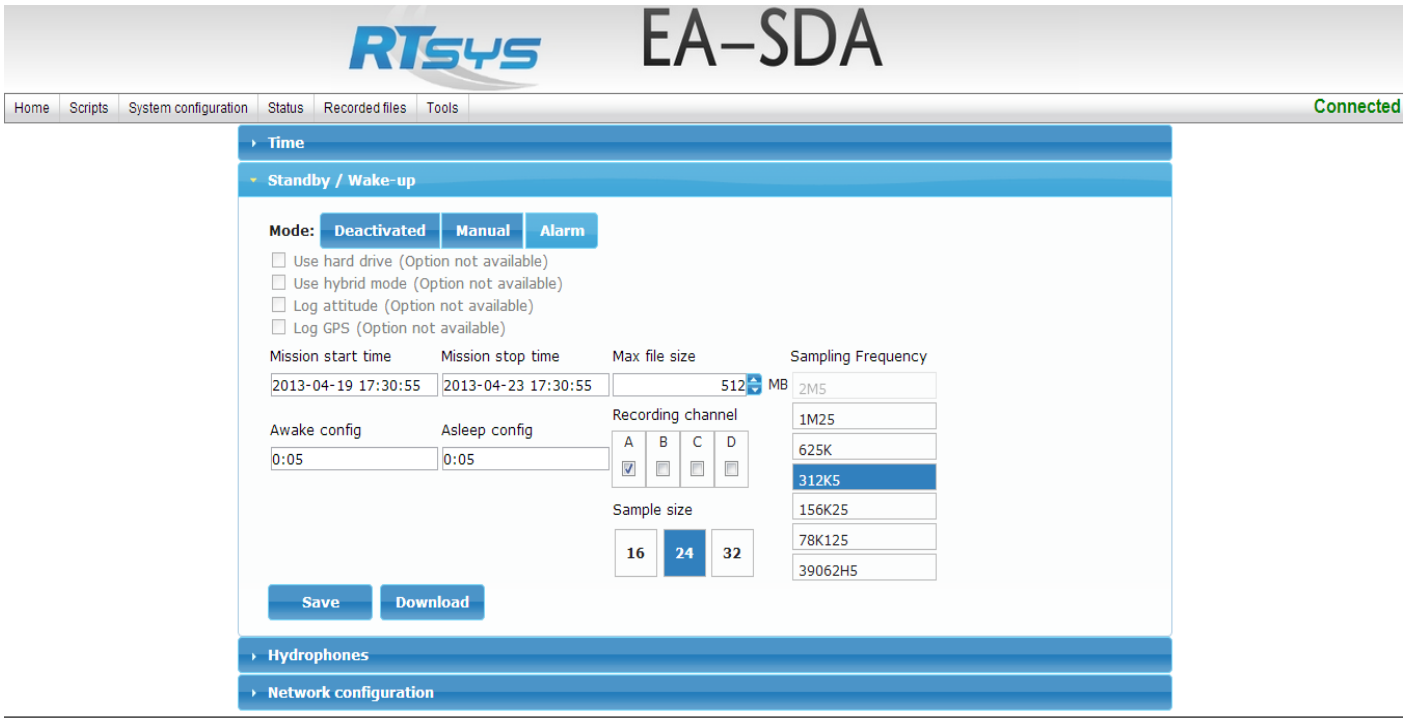
System is configurable through the web interface:



Copyright RTSYS 2011

Figure 6 : System configuration panel

The schedule is defined before the mission with a start/stop date and an active/sleep period:



Copyright RTSYS 2011

Figure 7: Mission schedule programming

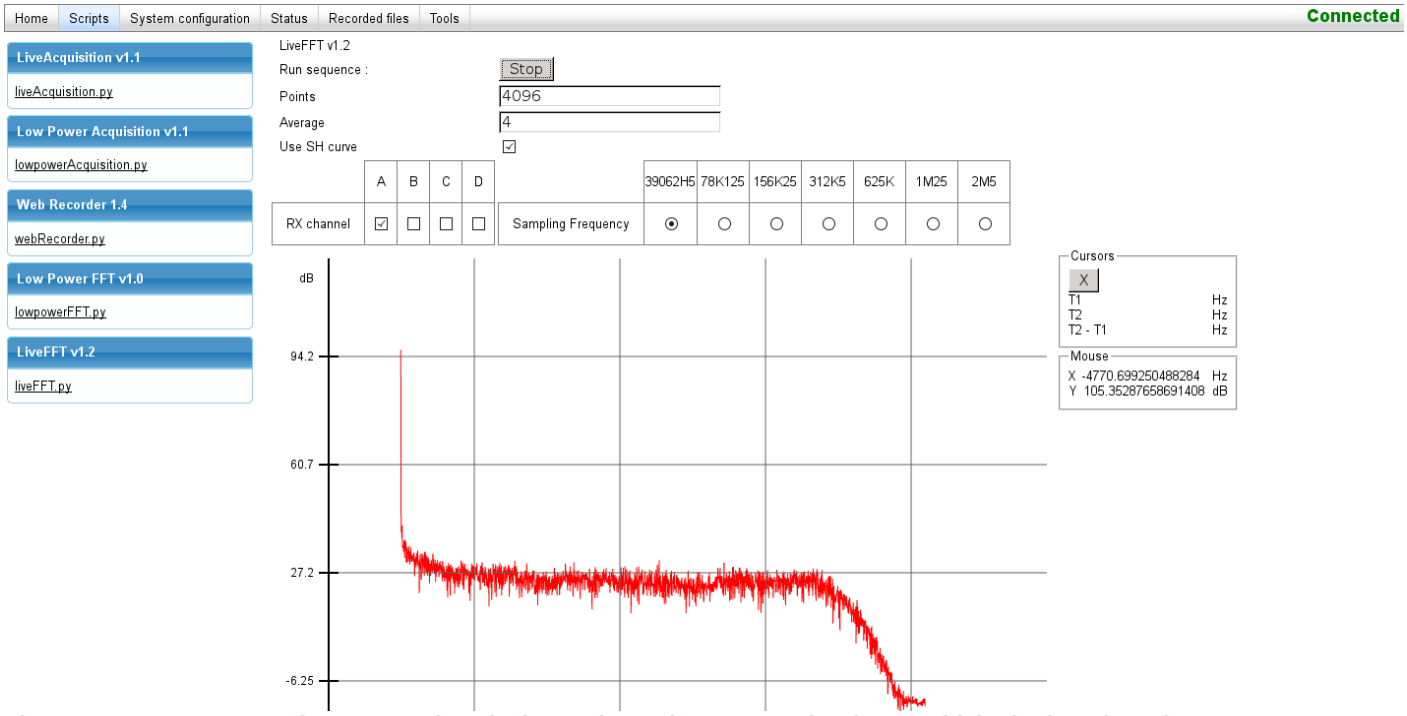


Figure 8 : Measure example – Spectral analysis on channel A at 39.062k5S/s. Sensitivity in dB ref 1 volt

The recorded files are listed in a dedicated panel. These files can be downloaded from the web interface or from a terminal (Command line).

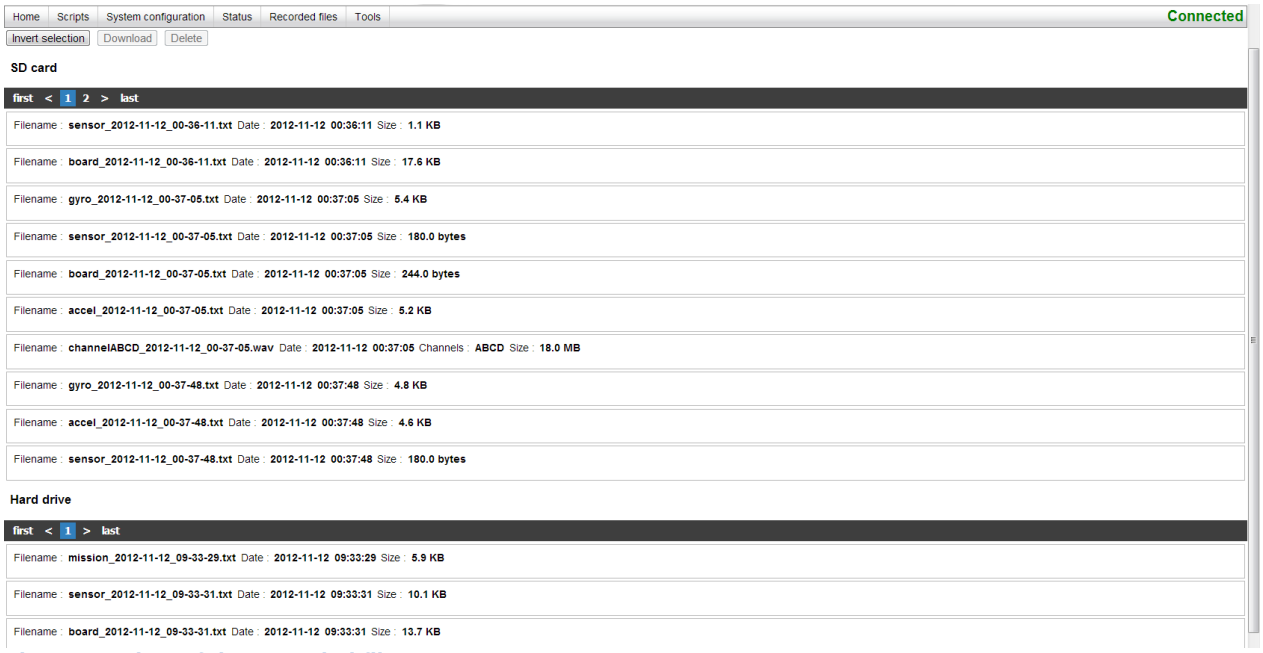

Home
Scripts
System configuration
Status
Recorded files
Tools
Connected
Invert selection
Download
Delete
SD card
first < 1 2 > last
Filename : sensor_2012-11-12_00-36-11.txt Date : 2012-11-12 00:36:11 Size : 1.1 KB
Filename : board_2012-11-12_00-36-11.txt Date : 2012-11-12 00:36:11 Size : 17.6 KB
Filename : gyro_2012-11-12_00-37-05.txt Date : 2012-11-12 00:37:05 Size : 5.4 KB
Filename : sensor_2012-11-12_00-37-05.txt Date : 2012-11-12 00:37:05 Size : 180.0 bytes
Filename : board_2012-11-12_00-37-05.txt Date : 2012-11-12 00:37:05 Size : 244.0 bytes
Filename : accel_2012-11-12_00-37-05.txt Date : 2012-11-12 00:37:05 Size : 5.2 KB
Filename : channelABCD_2012-11-12_00-37-05.wav Date : 2012-11-12 00:37:05 Channels : ABCD Size : 18.0 MB
Filename : gyro_2012-11-12_00-37-48.txt Date : 2012-11-12 00:37:48 Size : 4.8 KB
Filename : accel_2012-11-12_00-37-48.txt Date : 2012-11-12 00:37:48 Size : 4.6 KB
Filename : sensor_2012-11-12_00-37-48.txt Date : 2012-11-12 00:37:48 Size : 180.0 bytes
Hard drive
first < 1 > last
Filename : mission_2012-11-12_09-33-29.txt Date : 2012-11-12 09:33:29 Size : 5.9 KB
Filename : sensor_2012-11-12_09-33-31.txt Date : 2012-11-12 09:33:31 Size : 10.1 KB
Filename : board_2012-11-12_09-33-31.txt Date : 2012-11-12 09:33:31 Size : 13.7 KB

Figure 9 : View of the recorded files

Status window:

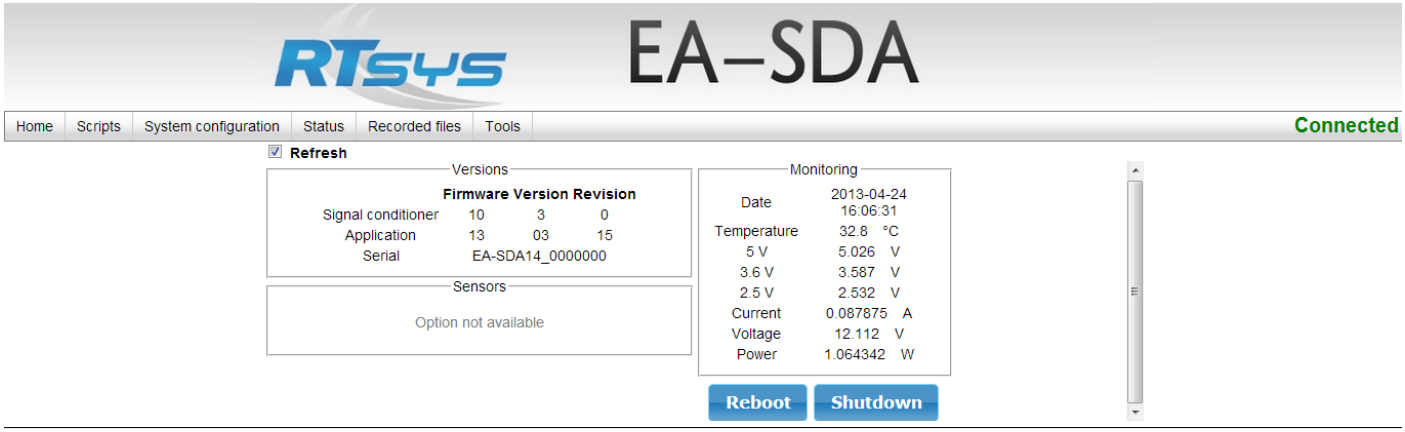


Figure 5: View of the status panel

There is also a tools panel which allows downloading Firefox, Flash Player, RTWaveInfo, RTWaveSplit and EA-SDA14_Locator. These software are helpful for easier post analysis of recorded data.

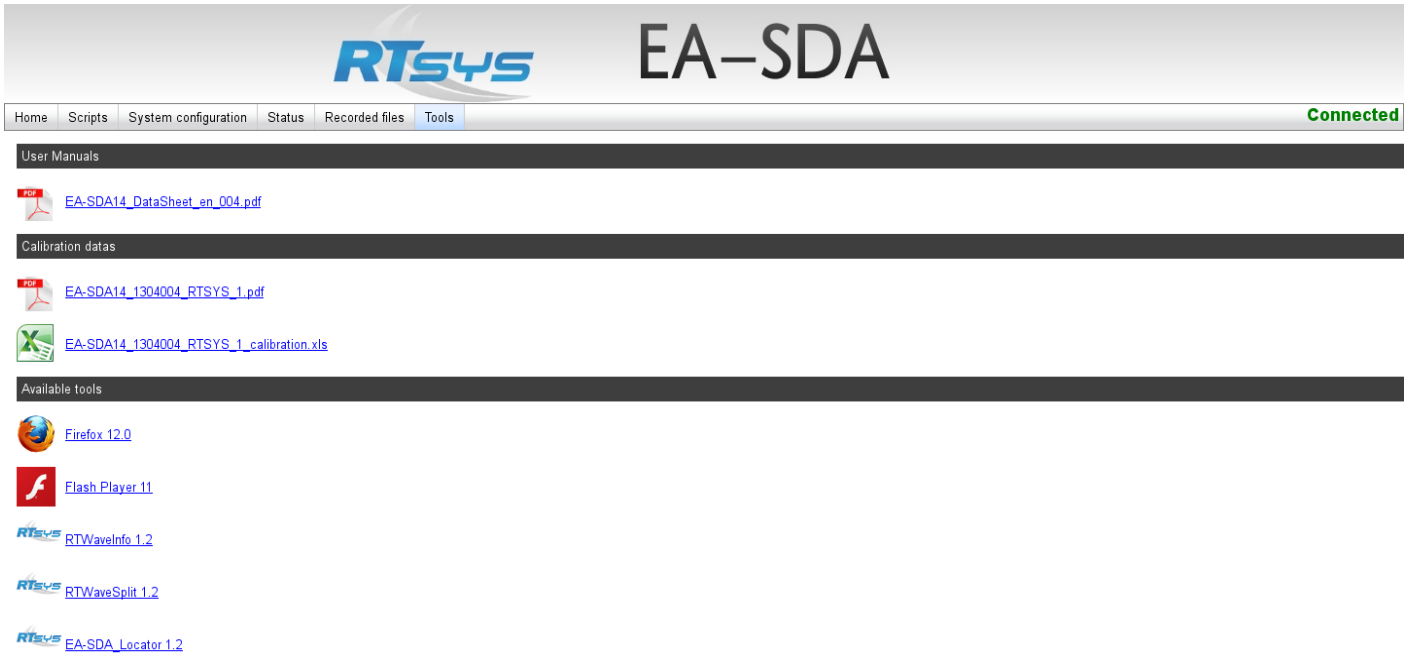


Figure 6 : View of the tools panel

Contact

RTSYS

SIRET : 52420113400029
RCS : Lorient B 524 201 134

Address

RTSYS
25 Rue Michel Marion
56850 CAUDAN
France

Phone

+33 2 97 89 85 80

Email

sales@rtsys.fr
support@rtsys.fr

Notes

Specifications are subject to change without notice
Information furnished by RTSYS is believed to be accurate and reliable. However, no responsibility is assumed for its use.